

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-050677

(43)Date of publication of application : 23.02.2001

(51)Int.CI.

F28F 1/02  
B21D 53/04  
F28F 1/00

(21)Application number : 11-226048

(71)Applicant : ZEXEL VALEO CLIMATE CONTROL CORP

(22)Date of filing : 10.08.1999

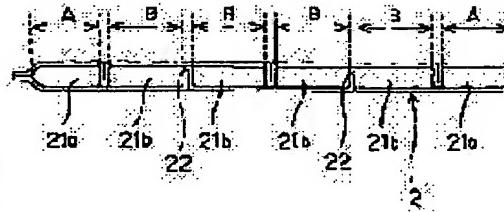
(72)Inventor : KATO SOICHI

## (54) HEAT EXCHANGER

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a heat exchanger where the pressure resistance of the tube is improved.

**SOLUTION:** In a heat exchanger, which performs the heat exchange of a medium by the heat conducted to a tube, equipped with a flat tube provided with a plurality of passages for circulating media, the tube 2 is made by rolling a plate and also in the cross section of the tube, the passage 21a positioned at the end in width direction is made smaller in sectional area than other passages 21b. Furthermore, the plate is provided with a plurality of crooked projections 22 and 22, and the plural projections are made by sizing the plural curves after forming these in the key parts of the plate, and also other curves directed in reverse to them are made between the curves, and at sizing, the curves are returned gradually to flat curves.



## LEGAL STATUS

[Date of request for examination] 23.08.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**CLAIMS**

[Claim(s)]

[Claim 1] The passage located in a crosswise edge in the cross section of said tube while said tube comes to carry out roll forming of the plate in the heat exchanger which performs heat exchange of said medium with the heat which is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and gets across to said tube is a heat exchanger characterized by forming the cross section small rather than other passage. [Claim 2] The cross section of the passage located in said crosswise edge is a heat exchanger according to claim 1 characterized by the range of the ratio being 0.80–0.95 to the cross section of the passage of said others.

[Claim 3] Said two or more passage is heat exchangers according to claim 1 or 2 characterized by having inserted and soldered and preparing an inner fin in the interior of said tube.

[Claim 4] The heat exchanger according to claim 3 characterized by preparing equally the potential of the inside of said tube, and the front face of said inner fin.

[Claim 5] It is the heat exchanger according to claim 1 or 2 which crookedness shaping is carried out, and said two or more passage prepares two or more projected parts in said plate, and is further characterized by forming said two or more projected parts of all in one side of the field of said plate which counters.

[Claim 6] For said tube, 5 is [ claim 1 characterized by coming to cut longitudinal direction both ends to coincidence by the cutting edge of the pair which set up predetermined spacing thru/or ] the heat exchanger of a publication either.

[Claim 7] Cutting of said tube is a heat exchanger according to claim 6 characterized by being made synchronizing with said roll forming.

[Claim 8] In the heat exchanger which performs heat exchange of said medium with the heat which is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and gets across to said tube said tube While coming to carry out roll forming of the plate, said two or more passage Crookedness shaping is carried out and two or more projected parts are prepared in said plate. Said two or more projected parts The heat exchanger which comes to carry out sizing of these, and forms other bends of the reverse sense with them between said bends after forming two or more bends in the key point of said plate, and is characterized by coming to return the bend evenly gradually in the case of said sizing.

[Translation done.]

## \* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

## [0001]

[Field of the Invention] This invention is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and relates to the heat exchanger which performs heat exchange of a medium with the heat which gets across to a tube.

## [0002]

[Description of the Prior Art] Generally, heat exchangers, such as a capacitor, and an evaporator, a heater core, are equipped with a flat-like tube, and they are constituted so that the heat which gets across to a tube may perform heat exchange of a medium. Moreover, the passage which circulates a medium so that this kind of tube may improve pressure resistance and heat-conducting characteristic continues crosswise, and is prepared. [ two or more ]

## [0003]

[Problem(s) to be Solved by the Invention] By the way, in the case of the tube of the shape of flat [ which prepared two or more passage which circulates a medium as mentioned above ], the destruction by excess of a proof pressure had the remarkable case where it is generated from the passage located in a crosswise edge.

[0004] This is considered because the wall which pays a pressure only from one side as compared with other passage becomes large if it is in the passage located in a crosswise edge.

[0005] Then, this invention aims at offering the heat exchanger which improved the pressure resistance of a tube further in view of such a problem.

## [0006]

[Means for Solving the Problem] In the heat exchanger which performs heat exchange of said medium with the heat which invention indicated to the 1st claim of this application is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and gets across to said tube, while said tube comes to carry out roll forming of the plate, in the cross section of said tube, the passage located in a crosswise edge is the heat exchanger of a configuration of having formed the cross section small rather than other passage.

[0007] Thus, while a tube comes to carry out roll forming of the plate according to the heat exchanger of this claim, since the passage located in a crosswise edge formed the cross-sectional area small rather than other passage, in the cross section of a tube, it can be further improved in the pressure resistance of a tube.

[0008] That is, since destruction according to an excess of a proof pressure the case of the tube of the shape of flat [ which prepared two or more passage which circulates a medium ] can mitigate the pressure burden of a medium in the passage located in a crosswise edge according to this invention the place whose case where it is generated from the passage located in a crosswise edge was remarkable, it can avoid such un-arranging.

[0009] The cross section of the passage where invention indicated to the 2nd claim of this application is located in said crosswise edge in claim 1 is the heat exchanger of a configuration of that the range of the ratio is 0.80-0.95 to the cross section of the passage of said others.

[0010] Thus, according to the heat exchanger of this claim, to the cross section of other

passage, since the range of the ratio is 0.80–0.95, the cross section of the passage located in a crosswise edge can be efficiently improved in the pressure resistance of a tube.

[0011] That is, since the ratio was suitably set as the range by this invention although the big gap arose in those passage resistance when the cross section of the passage located in a crosswise edge was extremely small compared with the cross section of other passage, it is possible to secure pressure resistance and passage resistance with sufficient balance.

[0012] Setting invention indicated to the 3rd claim of this application to claim 1 or 2, said two or more passage is the heat exchangers of a configuration of having inserted and soldered and having prepared the inner fin in the interior of said tube.

[0013] Thus, since according to the heat exchanger of this claim it inserted and soldered and two or more passage prepared the inner fin in the interior of a tube, the tube concerned can be created easily.

[0014] Invention indicated to the 4th claim of this application is the heat exchanger of a configuration of having prepared equally the potential of the inside of said tube and the front face of said inner fin in claim 3.

[0015] Thus, since the potential of the inside of a tube and the front face of an inner fin was prepared equally according to the heat exchanger of this claim, it is possible to improve the corrosion resistance of a tube and it is possible to use suitably as a heater core or a radiator especially.

[0016] That is, although the part to which corrosion goes remarkably by \*\* of the potential may be made if the potentials of the inside of a tube and the front face of an inner fin differ, according to this invention, it is possible to avoid such un-arranging certainly, and it is possible to acquire the life of a tube to satisfaction.

[0017] Invention indicated to the 5th claim of this application carries out crookedness shaping of said two or more passage in claim 1 or 2 at said plate, two or more projected parts are prepared, and said two or more projected parts of all are the heat exchangers of a configuration of having formed in one side of the field of said plate which counters further.

[0018] Thus, since according to the heat exchanger of this claim crookedness shaping was carried out, two or more passage prepared two or more projected parts in the plate and further two or more projected parts of all were formed in one side of the field of said plate which counters, a projected part can be fabricated correctly.

[0019] That is, although such a projected part is pulled unnecessarily and may deform in connection with bending of the plate in roll forming, according to this invention, a plate can be bent, pulling the field in which a projected part is not formed, consequently it can prevent deformation of a projected part.

[0020] It is the heat exchanger of a configuration of that invention indicated to the 6th claim of this application comes to cut longitudinal direction both ends to coincidence by the cutting edge of the pair to which said tube set predetermined spacing in claim 1 thru/or either of 5.

[0021] Thus, according to the heat exchanger of this claim, since it comes to cut longitudinal direction both ends to coincidence by the cutting edge of the pair which set up predetermined spacing, a tube can obtain the die-length dimension of a tube correctly.

[0022] Invention indicated to the 7th claim of this application is the heat exchanger of a configuration of that cutting of said tube is made synchronizing with said roll forming in claim 6.

[0023] Thus, according to the heat exchanger of this claim, cutting of a tube can create a tube efficiently while being able to obtain the die-length dimension of a tube correctly, since it is made synchronizing with roll forming.

[0024] In the heat exchanger which performs heat exchange of said medium with the heat which invention indicated to the 8th claim of this application is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and gets across to said tube While said tube comes to carry out roll forming of the plate, said two or more passage Crookedness shaping is carried out and two or more projected parts are prepared in said plate. Said two or more projected parts After forming two or more bends in the key point of said plate, it is the heat exchanger of a configuration of them forming other bends of the reverse sense between said bends by coming to carry out sizing of these, and coming to return the bend in the

case of said sizing evenly gradually.

[0025] According to the heat exchanger of this claim, thus, a tube While coming to carry out roll forming of the plate, two or more passage Crookedness shaping is carried out and two or more projected parts are prepared in a plate. Two or more projected parts After forming two or more bends in the key point of a plate, it comes to carry out sizing of these. Between bends Other bends of the reverse sense are formed with them. In the case of sizing Since it comes to return the bend evenly gradually, it is possible to control a tensile stress suitably and the local meat and local \*\* of a plate, dispersion of spacing of a projected part, etc. can cancel the fault accompanying formation of a projected part efficiently.

[0026] That is, according to the tensile stress in a plate, although local meat and local \*\* may arise between projected parts or gap may arise at spacing of a projected part, according to this invention, it is possible to avoid such fault.

[0027]

[Embodiment of the Invention] Below, the example of this invention is explained at a detail based on a drawing.

[0028] As shown in drawing 1, the heat exchanger 1 of this example comes to make free passage connection of the edge of each tubes 2 and 2 at the header pipes 4 and 4 of a pair, respectively while carrying out the laminating of two or more tubes 2 and 2 through fins 3 and 3. For the upper and lower sides of the layer which consists of tubes 2 and 2 and fins 3 and 3, the reinforcement member slack side plates 5 and 5 are arranged.

[0029] Moreover, tubes 2 and 2, fins 3 and 3, the header pipes 4 and 4, and side plates 5 and 5 attach each part material which constitutes these, and are formed in one by heat-treating this attachment object all over a furnace.

[0030] A medium is taken in inside a heat exchanger 1 from inlet-port section 4a prepared in one header pipe 4, and after it circulates tubes 2 and 2, carrying out heat exchange with the heat which gets across to tubes 2 and 2, it is discharged from outlet section 4b prepared in the header pipe 4 of another side.

[0031] Moreover, as shown in drawing 2, while a tube 2 presents the shape of flat, it continues crosswise [ the ] and two or more passage 21a, 21a, 21b, and 21b is formed.

[0032] And in the cross section of a tube 2, the passage 21a and 21a located in a crosswise edge forms the cross section small rather than the other passage 21b and 21b.

[0033] That is, in this example, as shown in this drawing, the width of face A of passage 21a located in a crosswise edge is set up smaller than the width of face B of other passage 21b.

[0034] Especially the ratio of the cross section of the passage 21a and 21a located in a crosswise edge is set as the range of 0.80–0.95 to the other passage 21b and 21b.

[0035] Thus, about the passage 21a and 21a located in the crosswise edge of this tube 2, the pressure burden of a medium is suitably mitigated by making the cross section small.

[0036] Moreover, drawing 3 is the explanatory view showing the production process of the tube 2 of this example.

[0037] As shown in this drawing, about the plate P made from an aluminium alloy, it fabricates and solders, a tube 2 becomes, and shaping of Plate P is made through the roll-forming process 60 and the cutting process 70.

[0038] Among two or more rolls (illustration is omitted) by which opposite arrangement was carried out, the roll-forming process 60 passes Plate P, and is performed.

[0039] Moreover, two or more passage 21a, 21a, 21b, and 21b of a tube 2 is established in both sides of the plate P which counters in the roll-forming process 60 by carrying out crookedness formation of two or more projected parts 22 and 22, respectively. The tip of projected parts 22 and 22 is soldered at the inside of a tube 2.

[0040] In addition, the projected part 22 of this example is formed by carrying out sizing of this, after preforming Bend Pa at the key point of Plate P, as shown in drawing 4.

[0041] As shown in this drawing, when forming two or more projected parts 22 and 22 in coincidence, two or more bends Pa and Pa are formed, and sizing of these [ both ] is carried out.

[0042] However, in this case, by the tensile stress in Plate P, local meat and local \*\* may arise

between a projected part 22 and a projected part 22, or gap may arise at spacing of projected parts 22 and 22.

[0043] Then, in such a case, as shown in drawing 5, a tensile stress is suitably controlled by their forming other bends Pb of the reverse sense, and returning other bends Pb evenly gradually among the bends Pa and Pa used as projected parts 22 and 22, in the case of sizing.

[0044] According to such a configuration, the local meat and local \*\* of Plate P, dispersion of spacing of projected parts 22 and 22, etc. can cancel efficiently the fault accompanying formation of projected parts 22 and 22.

[0045] Moreover, according to forming two or more projected parts 22 and 22 in coincidence, the number of rolls which roll forming takes can also be reduced.

[0046] The cutting process 70 is a process which cuts that by which roll forming was carried out to predetermined die length, and a tube 2 is cut by coincidence in longitudinal direction both ends by the cutting edge 71 of the pair which set up predetermined spacing.

[0047] Moreover, cutting of this tube 2 is made synchronizing with roll forming. That is, the cutting edge 71 of a pair is constituted so that it aligns with the rate which sends Plate P, and both-way migration is carried out, and vertical migration may be carried out and a tube 2 may be cut.

[0048] In addition, although what formed small the cross section of the passage 21a and 21a of both which are located in a crosswise edge, respectively was explained, pressure resistance may be made for passage 21a of one of these to improve by making the junction firmly in this example, while forming in the joint of a plate, and one as shown in drawing 6. In this case, the cross section of one passage 21a may be formed similarly to the cross section B of other passage 21b more greatly than it.

[0049] Furthermore, as shown in drawing 6, two or more projected parts 22 and 22 may also constitute so that the tips of the projected parts 22 and 22 which carried out crookedness formation, respectively may be compared to both sides of the plate which counters.

[0050] Moreover, the tube 2 shown in drawing 6 is formed so that the profile of a cross section may serve as point symmetry which is 180 degrees. According to such a configuration, it is possible to attach them, even if the sense of a tube 2 differs, in case a tube 2 and the header pipe 4 are attached. Thus, you may improve the attachment nature of a tube 2 and the header pipe 4.

[0051] As explained above, while a tube comes to carry out roll forming of the plate according to the heat exchanger of this example, since the passage located in a crosswise edge formed the cross-sectional area small rather than other passage, in the cross section of a tube, it can improve the pressure resistance of a tube further.

[0052] That is, according to this example the place whose case where it is generated from the passage located in a crosswise edge was remarkable, in the passage located in a crosswise edge, since destruction according to an excess of a proof pressure the case of the tube of the shape of flat [ which prepared two or more passage which circulates a medium ] can mitigate the pressure burden of a medium, it can avoid such un-arranging.

[0053] Moreover, according to the heat exchanger of this example, to the cross section of other passage, since the range of the ratio is 0.80–0.95, the cross section of the passage located in a crosswise edge can improve the pressure resistance of a tube efficiently.

[0054] Namely, if the cross section of the passage located in a crosswise edge is extremely small compared with the cross section of other passage, a big gap will arise in those passage resistance, but since the ratio was suitably set as the range, pressure resistance and passage resistance are securable in this example, with sufficient balance.

[0055] Moreover, according to the heat exchanger of this example, since a tube comes to cut longitudinal direction both ends to coincidence by the cutting edge of the pair which set up predetermined spacing, it can obtain the die-length dimension of a tube correctly.

[0056] Moreover, according to the heat exchanger of this example, it can create a tube efficiently while it can obtain the die-length dimension of a tube correctly, since cutting of a tube is made synchronizing with roll forming.

[0057] Next, the 2nd example of this invention is explained based on drawing 7.

[0058] As shown in drawing 7, in the case of the tube 2 of this example, two or more projected parts 22 and 22 are formed in one side of the field of the plate which counters altogether. In addition, since it is the same as that of the example mentioned above about other fundamental configurations, the explanation is omitted.

[0059] Since according to the heat exchanger of this example crookedness shaping was carried out, two or more passage prepared two or more projected parts in the plate and further two or more projected parts of all were formed in one side of the field of the plate which counters, a projected part can be fabricated correctly.

[0060] That is, although such a projected part is pulled unnecessarily and may deform in connection with bending of the plate in roll forming, according to this example, it can bend a plate, pulling the field in which a projected part is not formed, consequently can prevent deformation of a projected part.

[0061] Next, the 3rd example of this invention is explained based on drawing 8.

[0062] As shown in drawing 8, in the case of the tube 2 of this example, it inserted and soldered and two or more passage 21a, 21a, 21b, and 21b provides the inner fins 23 and 23 in the interior of a tube 2. Moreover, the potential of the inside of a tube 2 and the front face of the inner fins 23 and 23 is prepared equally. In addition, since it is the same as that of the example mentioned above about other fundamental configurations, the explanation is omitted.

[0063] That is, the inside of a tube 2 and the front face of the inner fin 23 make potential equal by sticking the respectively same sacrifice material.

[0064] As sacrifice material, the aluminium alloys (JIS A7072 alloy etc.) which contain zinc several% are used.

[0065] Since according to the heat exchanger of this example it inserted and soldered and two or more passage prepared the inner fin in the interior of a tube, the tube concerned can be created easily.

[0066] Moreover, since the potential of the inside of a tube and the front face of an inner fin was prepared equally according to the heat exchanger of this example, the corrosion resistance of a tube can be improved.

[0067] That is, although the part to which corrosion goes remarkably by \*\* of the potential may be made if the potentials of the inside of a tube and the front face of an inner fin differ, according to this example, it can avoid such un-arranging certainly and the life of a tube can be acquired to satisfaction.

[0068] Therefore, LLC can be suitably used especially for this heat exchanger as the circulating heater core and a radiator.

[0069] In the heat exchanger which performs heat exchange of a medium with the heat which is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium according to the heat exchange of this example ], and gets across to a tube moreover, a tube While coming to carry out roll forming of the plate, two or more passage Crookedness shaping is carried out and two or more projected parts are prepared in a plate. Two or more projected parts After forming two or more bends in the key point of a plate, it comes to carry out sizing of these. Between bends Other bends of the reverse sense are formed with them. In the case of sizing Since it comes to return the bend evenly gradually, a tensile stress can be controlled suitably and the local meat and local \*\* of a plate, dispersion of spacing of a projected part, etc. can cancel the fault accompanying formation of a projected part efficiently.

[0070] That is, according to the tensile stress in a plate, although local meat and local \*\* may arise between projected parts or gap may arise at spacing of a projected part, according to this example, such fault is avoidable.

[0071]

[Effect of the Invention] While a tube comes to carry out roll forming of the plate according to the heat exchanger indicated to the 1st claim of this application, since the passage located in a crosswise edge formed the cross-sectional area small rather than other passage, in the cross section of a tube, it can improve the pressure resistance of a tube further.

[0072] That is, according to this invention the place whose case where it is generated from the passage located in a crosswise edge was remarkable, in the passage located in a crosswise edge,

since destruction according to an excess of a proof pressure the case of the tube of the shape of flat [ which prepared two or more passage which circulates a medium ] can mitigate the pressure burden of a medium, it can avoid such un-arranging.

[0073] According to the heat exchanger indicated to the 2nd claim of this application, to the cross section of other passage, since the range of the ratio is 0.80-0.95, the cross section of the passage located in a crosswise edge can improve the pressure resistance of a tube efficiently.

[0074] Namely, if the cross section of the passage located in a crosswise edge is extremely small compared with the cross section of other passage, a big gap will arise in those passage resistance, but since the ratio was suitably set as the range, pressure resistance and passage resistance are securable in this invention, with sufficient balance.

[0075] Since according to the heat exchanger indicated to the 3rd claim of this application it inserted and soldered and two or more passage prepared the inner fin in the interior of a tube, the tube concerned can be created easily.

[0076] Since the potential of the inside of a tube and the front face of an inner fin was prepared equally according to the heat exchanger indicated to the 4th claim of this application, the corrosion resistance of a tube can be improved.

[0077] That is, although the part to which corrosion goes remarkably by \*\* of the potential may be made if the potentials of the inside of a tube and the front face of an inner fin differ, according to this invention, it can avoid such un-arranging certainly and the life of a tube can be acquired to satisfaction.

[0078] Since according to the heat exchanger indicated to the 5th claim of this application crookedness shaping was carried out, two or more passage prepared two or more projected parts in the plate and further two or more projected parts of all were formed in one side of the field of said plate which counters, a projected part can be fabricated correctly.

[0079] That is, although such a projected part is pulled unnecessarily and may deform in connection with bending of the plate in roll forming, according to this invention, it can bend a plate, pulling the field in which a projected part is not formed, consequently can prevent deformation of a projected part.

[0080] According to the heat exchanger indicated to the 6th claim of this application, since a tube comes to cut longitudinal direction both ends to coincidence by the cutting edge of the pair which set up predetermined spacing, it can obtain the die-length dimension of a tube correctly.

[0081] According to the heat exchanger indicated to the 7th claim of this application, it can create a tube efficiently while it can obtain the die-length dimension of a tube correctly, since cutting of a tube is made synchronizing with roll forming.

[0082] In the heat exchanger which performs heat exchange of a medium with the heat which invention indicated to the 8th claim of this application is equipped with the tube of the shape of flat [ which prepared two or more passage which circulates a medium ], and gets across to a tube a tube While coming to carry out roll forming of the plate, two or more passage Crookedness shaping is carried out and two or more projected parts are prepared in a plate. Two or more projected parts After forming two or more bends in the key point of a plate, it comes to carry out sizing of these. Between bends Other bends of the reverse sense are formed with them. In the case of sizing Since it comes to return the bend evenly gradually, a tensile stress can be controlled suitably and the local meat and local \*\* of a plate, dispersion of spacing of a projected part, etc. can cancel the fault accompanying formation of a projected part efficiently.

[0083] That is, according to the tensile stress in a plate, although local meat and local \*\* may arise between projected parts or gap may arise at spacing of a projected part, according to this invention, such fault is avoidable.

[Translation done.]

\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**DESCRIPTION OF DRAWINGS**

[Brief Description of the Drawings]

[Drawing 1] It is the front view in which starting the example of this invention and showing a heat exchanger.

[Drawing 2] It is the sectional view in which starting the example of this invention and showing a tube.

[Drawing 3] It is the explanatory view in which starting the example of this invention and showing the production process of a tube.

[Drawing 4] It is the explanatory view in which starting the example of this invention and showing shaping of the projected part of a tube.

[Drawing 5] It is the explanatory view in which starting the example of this invention and showing shaping of the projected part of a tube.

[Drawing 6] It is the sectional view in which starting the example of this invention and showing a tube.

[Drawing 7] It is the sectional view in which starting the example of this invention and showing a tube.

[Drawing 8] It is the sectional view in which starting the example of this invention and showing a tube.

[Description of Notations]

1 Heat Exchanger

2 Tube

3 Fin

4 Header Tank

4a Inlet-port section

4b Outlet section

5 Side Plate

21a Passage

21b Passage

22 Projected Part

23 Inner Fin

60 Roll-Forming Process

70 Cutting Process

71 Cutting Edge

P Plate

Pa Bend

Pb Bend

A Width of face

B Width of face

[Translation done.]

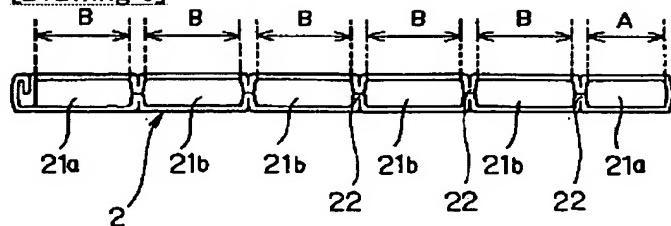
\* NOTICES \*

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

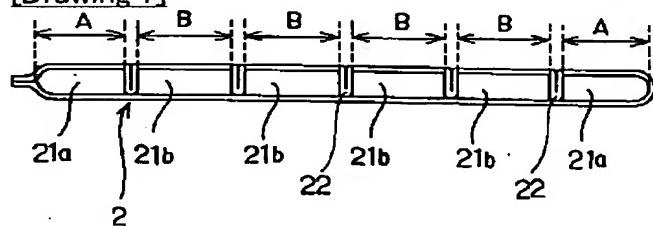
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**DRAWINGS**

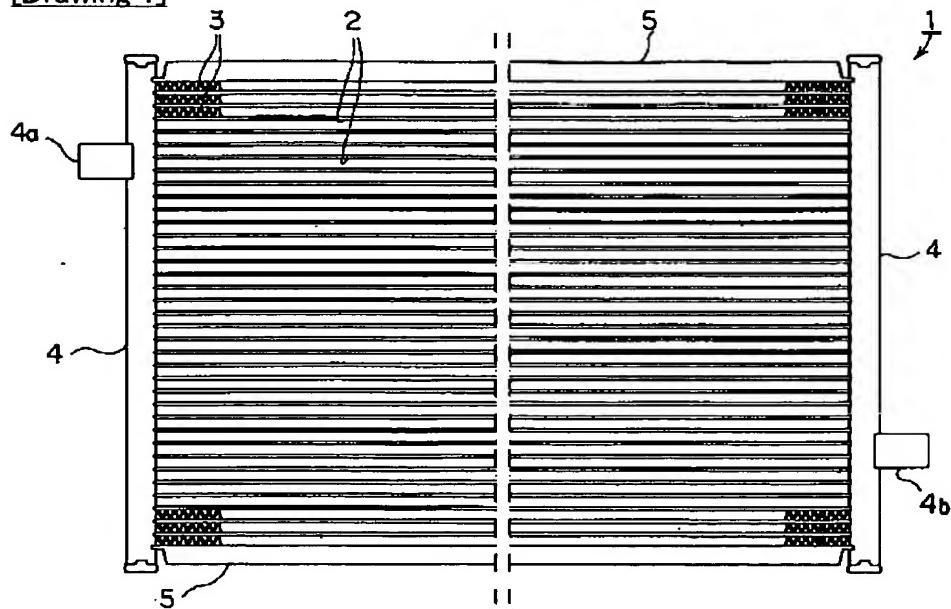
[Drawing 6]



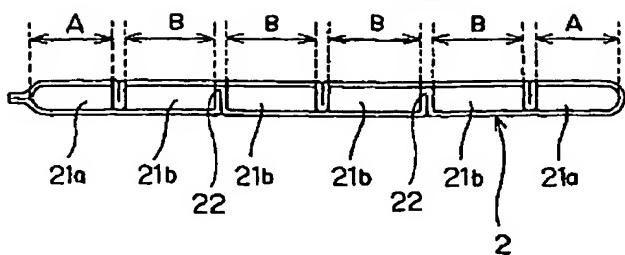
[Drawing 7]



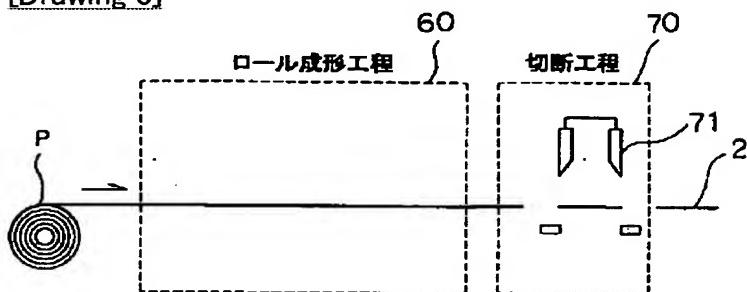
[Drawing 1]



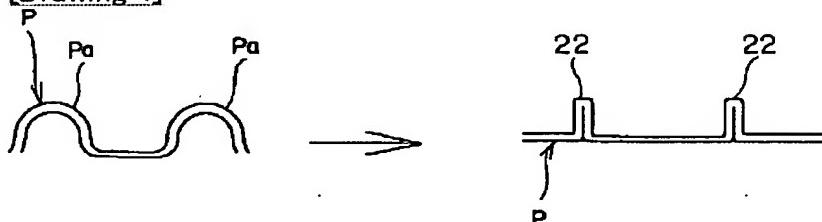
[Drawing 2]



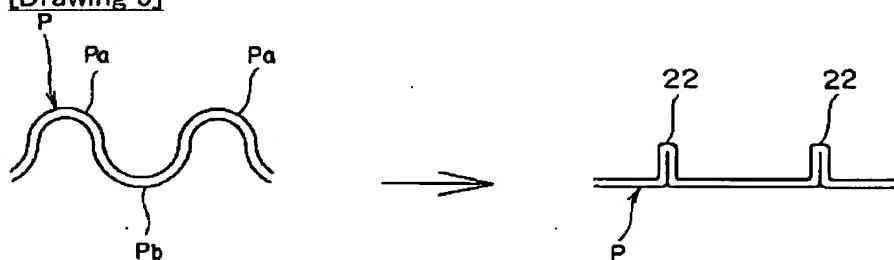
[Drawing 3]



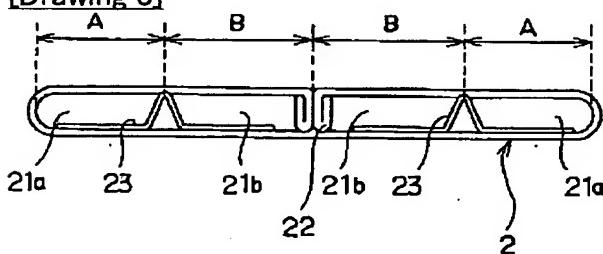
[Drawing 4]



[Drawing 5]



[Drawing 8]



[Translation done.]